STEERABLE UNDERGROUND BORING TOOL

GRUNDOSTEER
Operators & Parts Manual

TT TECHNOLOGIES, Inc.

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Important Safety Instructions

1.

This symbol calls attention to important safety instructions which, if not followed, could result in serious personal injury or death.

Read, understand and observe all safety information and instructions in this manual, and on safety decals on the GRUNDOSTEER piercing tool before using it. For safety reasons, read the operators manual carefully and exercise caution while using the GRUNDOSTEER piercing tool. Please note specific safety requirements as explained by procedures called out in this manual. Failure to follow these instructions could result in serious personal injury or death.

All tools, materials and equipment manufactured and supplied by TT Technologies, Inc. are designed to be used by qualified and trained personnel only. TT Technologies, Inc. will not be held liable for any injury or damage to either people or property resulting from the misuse of TT Technologies equipment.

Please save this user's guide for future reference and have it available to all operating personnel. Personnel should thoroughly read this operating manual.

CAUTION: When working with compressed air, follow necessary precautions to avoid injury.

WARNING: Before you dig, contact the local utilities to determine the location of all area service lines.

DANGER: Contact with electrical lines may result in death or injury. The user should be properly trained in correct procedures for work around electrical lines.

SAVE THESE INSTRUCTIONS

Follow all safety instructions concerning safety and possible danger.

Do not modify or remove the safety devices or warning labels of this machine. Keep all labels regarding safety and possible danger on the machine in good, readable condition. Special care is required before and during the safety check.

Every crewmember should fully understand the safety measures required for the operation and should be capable of following these regulations individually.

GRUNDOSTEER is manufactured to the current technical safety-relevant regulations. Nevertheless, the use of the machine may represent a danger to the health and life of users or third parties. Always ensure that you pay particular attention to warnings, safety labels and instructions.

Read Operators Manual

Before starting the machine, fulfill all safety related requirements. All personnel should thoroughly read this operating manual.

Follow all safety instructions concerning safety and possible danger. Do not modify or remove the safety devices or warning labels of this machine. Keep all labels regarding safety and possible danger on the machine in good, readable condition. Special care is required before and during the safety check.

Every crew member should fully understand the safety measures required for the operation and should be capable of following these regulations individually.

Call Before You Dig

Check the existence and exact position of buried pipe and cables by contacting the respective utilities or owners of networks. The exact and definite existence and position of buried cables and pipes should be defined by trial pits or using cable and pipe detection equipment or other means.

Cable Strike

Should you accidentally hit an electrical cable, immediately leave the site, ensure no one enters and contact the electrical company to turn off the supply. DO NOT touch the hose couplings or the control box. Be aware of the potential for current to be running through the hose. In case of a cablestrike, the danger resulting from that damaged electric cable can only be evaluated following detailed information by the respective electrical company. Never rely on your own knowledge as to types of cables, safety measures and protective measures that may not be correct for the type of cable encountered. Always consider cables to be “live” and a potential danger to life. Do not re-enter the site until authorized by the electrical company.

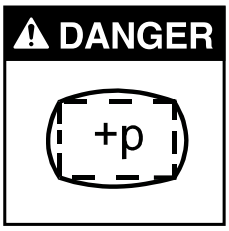
Danger of Entrapment

Do not place hand in moving machine components or devices. Always ensure that all safety guards, covers or other safety devices are correctly in place “before starting.” Do not remove safety covers or safety devices during operation of the machine.

No loose clothes

Do not wear loose clothes or long hair. Danger of body injury by loose clothes or hair being caught in the moving parts of the machine.

SAVE THESE INSTRUCTIONS



Do Not Over-Pressurize

Do not over pressurize, otherwise explosion or serious damage may occur. Do not exceed the operating pressure of 100 psi (7 bar). Make sure to only use original T.T. hoses with T.T. couplings that are suitable for this pressure.

Suspended loads

Do not stand under suspended (floating) loads. Danger of body injury by falling loads. Use suitable means of avoiding danger.

Safety Equipment

The operating crew should always wear the appropriate safety equipment, i.e., safety shoes/boots, hard hat, safety glasses, gloves, ear protection etc. Safety mats should also be used to protect from electrical shock.

Operation by Qualified Personnel Only

Operation of the GRUNDOSTEER should be carried out by suitably trained, qualified, and certified personnel only. New operators or operators in training should be working under the constant supervision of a qualified person. Personnel operating the GRUNDOSTEER should have sufficiently studied the operating manual.

Disconnecting Air Hoses

Only disconnect pressure free hoses. Always turn off the compressor and bleed all air before disconnecting hoses. Before starting any maintenance or inspection work, ensure that the GRUNDOSTEER is not connected to any air supply. During repair and maintenance operations always follow the respective safety recommendations. Repair and maintenance operations are restricted to trained and certified staff only.

Skin Burning Warning

This item can be hot or cold. Do not touch as burns may result.

Air Hose and GRUNDOSTEER Tool Maintenance

Never use self-swaged hoses. Swaging, re-fitting or replacement of air hoses should always be done in a specialist workshop only. Make sure that the hose couplings are properly tightened before starting the compressor. Check all hoses, pipe lines, fittings, joints and securing bolts daily for correct position and function before starting the bore. Use the machine only if it is in perfect working order and after studying the operating manual, particularly the safety-related sections. Always check the machine and its accessories for unwanted movements.

To guarantee long life, regular maintenance is essential. Inadequate or infrequent repair and maintenance operations may lead to accidents, downtime and costly repairs of the machine.

Transporting the GRUNDOSTEER Tool

Danger of accidents. The downward movement of the piston may lead to the GRUNDOSTEER slipping through the textile sling or through the operator's hand. Never lift or carry the machine using the air hose-damage to the hose may result. Handling and transporting the machine should be done on a flat, level surface only. Do not overload the transportation vehicle.

SAVE THESE INSTRUCTIONS

Using a Starting Cradle & Entrance & Exit Pit Excavation

It is recommended that the GRUNDOSTEER be used with the starting cradle for correct alignment. Do not touch the steel cable. Do not re-tension during operation. In case of boring above or below known utilities (electrical, gas, water, telecom or others) make sure that a starting cradle is used to align the machine onto the target point.

Secure the starting cradle so that the front is the length of the GRUNDOSTEER head assembly away from the front wall. The walls of the starting pit should be made vertical where the machine enters. If the soil in the starting pit is very soft and loose, then the cradle should be supported on wooden boards, fixed timber or other means. Always ensure that no buried services are beneath the starting cradle in the launch pit otherwise you may drive an earth anchor into them and cause serious damage.

Make sure there is a sufficient amount of ground cover.

Make sure that start and exit pits are excavated and shored as necessary to comply with OSHA regulations and guard against collapse.

Operation of the GRUNDOSTEER Tool

Start operation of the GRUNDOSTEER on reduced air (pressure) only. Always run the GRUNDOSTEER slowly into the ground.

The control unit/lubricator, should always be within reach of the operator.

In case of danger to people or machine, turn off the air supply from the compressor immediately. Always watch the behavior and reaction of your colleagues. In case of danger, take the necessary steps immediately.

Use recommended oils and lubricants only.

WARNING: System under pressure!

Firmly hold or block the hose end when cleaning the hose with compressed air. Point the hose away from body. Do not point hoses at others.

Respect a minimum safety distance from any over head live lines.

When operating beneath railroad tracks, all standards and requirements should be observed. Machine and equipment should be removed from a job site on the track-free side. Never cross the tracks unless supervised.

Call before you dig-Existing utilities should still be “pot-holed” for exact location.

Turn off compressor and bleed air before disconnecting any hoses.

Operate at 100 PSI.

Torquer wrench-when a steer is completed and you release the tension switch on the torque wrench there is often a “re-coil” effect. The wrench will spin around. Watch face. Keep both hands on wrench.

Utility companies will generally have safety mats, & safety boots, etc. implemented in their safety procedures.

SAVE THESE INSTRUCTIONS

General Information

1.

The 3-inch diameter GRUNDOSTEER is pneumatically powered and can bore up to 200 feet. Sensors on the tool provide pitch and roll information to the operator. An above ground locator is used to track the tool's position and movement (see Fig. 1).

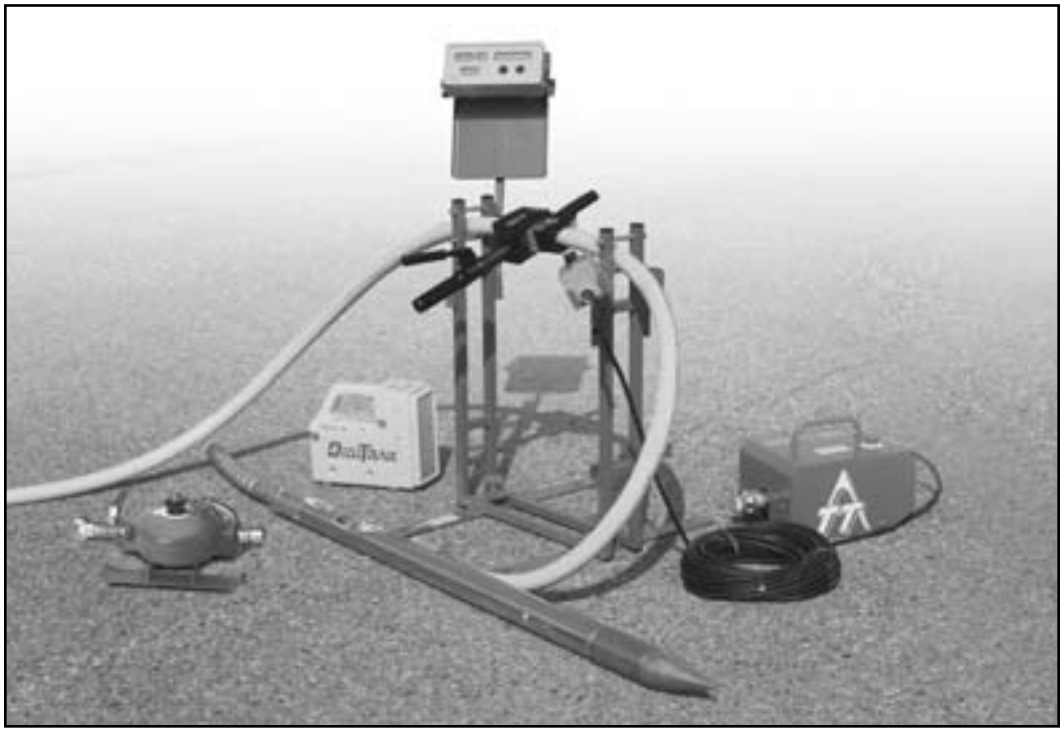


FIG. 1: GRUNDOSTEER

The operator can make adjustments to the tool's course by rotating the air hose with a hydraulic tensioning unit called a torquer. The tool does not require any special drilling fluid to work properly (see Fig. 2).

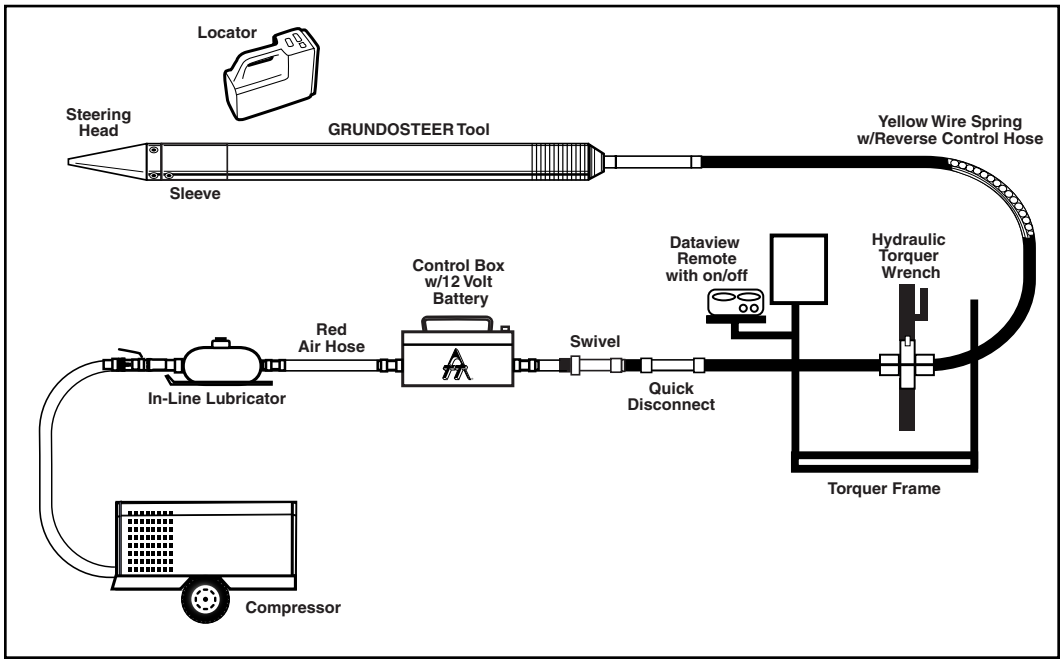


FIG. 2: TYPICAL SET UP OF THE GRUNDOSTEER

Applications

2.

- Installing up to 2-inch pipe for distances up to 200 ft.
- For shots with grade changes, multiple existing utilities to avoid, or turns and bends.
- Ideal for gas and water service lines

Technical Specifications

3.

- Tool length-87 inches
- Tool weight-85 pounds
- Tool diameter-3 inches

- Compressor requirements-35 cfm @ 95-105 psi

- Hose length and construction-1 1/4 inches by 65 ft single wire reinforced, positive lock quick disconnect couplers on both ends of the hose and tool

- Tool heads:
    - 0°-Straight Boring
    - 3°- Hard Soil
    - 5°- Standard/Normal Soil
    - 7°- Soft Soil
- Maximum bore length-200 ft.

- Sonde-DCI and RD -15 ft range, zero sleep, one AA battery (12 hour life)

- Receiver/Remote-DCI and RD - provide pitch, roll, and depth readings to operators
    - DCI-3 rechargeable battery packs and re-charger
    - RD-receiver takes 12 AA batteries / remote takes 2 C batteries

- Control unit-rechargeable 12 Volt battery

- Lubricator with ball valve to control air flow / oil consumption adjustment knob

Set Up

4.

A. Launch & Exit Pits

Launch pits should be approximately 7 feet long and a minimum of 30 inches deep. Each job site is different and should be evaluated accordingly. The GRUNDOSTEER can also be surface launched.

B. Head Assembly

1. Install 1 AA battery, positive side down, in sonde (see Fig. 3). Screw cap on tightly.

2. Attach sonde to adapter making sure 12 on sonde line up with 12 on adapter (see Fig. 4).

FIG. 3: INSTALL 1 AA BATTERY

FIG. 4: ATTACH SONDE

3. Slide sonde and adapter into front of GRUNDOSTEER tool (see Fig. 5); align holes for roll pins (see Fig. 6).

FIG. 5: SLIDE ON SONDE ADAPTER

FIG. 6: ALIGN HOLES

FIG. 7: INSTALL OUTER ROLL PIN

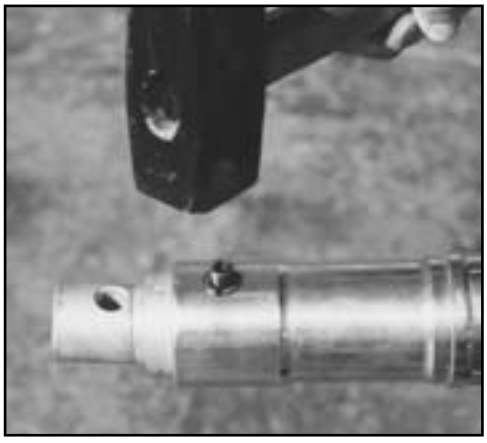


FIG. 8: INSTALL INNER ROLL PIN

4. Install outer roll pin beveled edge down (see Fig. 7).

   NOTE: Single solid steel pin also available for GRUNDOSTEER head assembly.

5. Install inner roll pin beveled edge down (be sure to stagger slits in outer and inner roll pins) (see Fig. 8).

6. Slide sleeve onto tool beveled edge first (this is the only way it will go on) (see Fig. 9). Check to see that sleeve will rotate freely. If not, take off and adjust roll pins with pin punch (one side is probably sticking out too far). When sure sleeve will rotate freely, take off sleeve and clean thoroughly. Slide sleeve back onto tool.

7. Slide on tapered head (see Fig. 10). It will only go on one way. The 12 o'clock on the head will align with the 12 on the sonde and sonde adapter.

FIG. 9: SLIDE ON SLEEVE

FIG. 10: SLIDE ON TAPERED HEAD

8. Install outer roll pin beveled edge down (see Fig. 11).

9. Install inner roll pin beveled edge down (be sure to stagger slits in outer and inner roll pins) (see Fig. 12).

FIG. 11: INSTALL OUTER ROLL PIN

FIG. 12: INSTALL INNER ROLL PIN

C. Tool Calibration

1. Lay tool on flat surface away from any overhead interference such as telephone lines.

2. Consult DCI or RD owner's manual for calibration instructions.

D. System Set Up

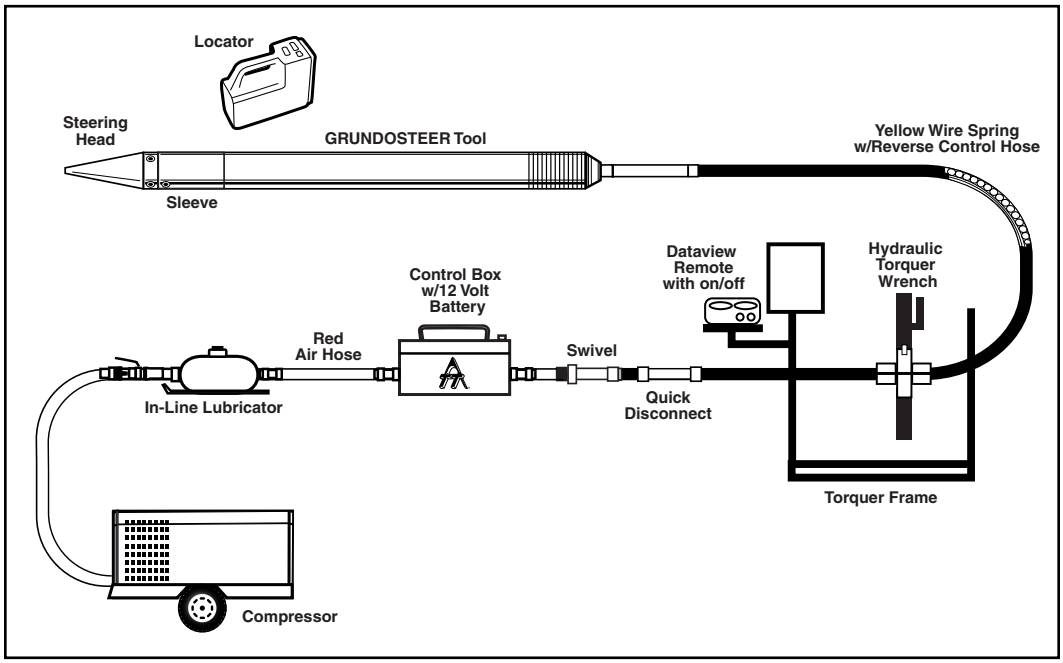


FIG. 13: TYPICAL SET UP OF THE GRUNDOSTEER

1. IN-LINE LUBRICATOR

Attach compressor hose (not supplied by TT) to ball valve side of lubricator (claw fitting) and secure with safety clip. Fill lubricator with Grundo-oil and set oil adjustment knob to the 3 setting. Set the lubricator next to the entry pit.

2. RED AIR HOSE

Run the supplied red air hose, 50 ft, from other end of lubricator directly behind entry pit or off to the side if obstacles are present behind the entry pit. Attach at lubricator using safety clip.

3. CONTROL BOX

Attach open end of red air hose using safety clip. Be sure emergency off switch is not pressed down which can happen during transport. Be sure battery terminals are connected and secure. Attach GRUNDOSTEER yellow hose female end to control box and run back towards entry pit (see Fig. 14).

NOTE: As the GRUNDOSTEER bores the control box will slide along with the hose toward the entry pit.

FIG. 14: ATTACH TO CONTROL BOX

4. TORQUER FRAME

Torquer frame should be set up at surface level directly in back of starting pit in line with the direction of the bore. Loosen the down screws at the bottom of the frame to adjust the frame's legs. Tighten before staking frame.

Use 2-ft anchor stakes provided to secure the frame (see Fig. 15). When working on concrete or surfaces where the frame cannot be staked down, use sandbags to secure the frame. Attach frame accessories remote holder, cup holder, and DCI or RD display unit holder.

FIG. 15: STAKE FRAME

FIG. 16: YELLOW AIR HOSE

5. YELLOW AIR HOSE

Attach only one length at a time to limit set up space needed. Be sure hose is laid out flat with no kinks. Feed open end of GRUNDOSTEER hose through the torque frame (see Fig. 16).

NOTE: Make sure the airline (hose) is free of obstructions before using. Make sure that all airlines are in good working order and condition before use.

6. HYDRAULIC TORQUER WRENCH

Remove clip and pin from top of wrench and remove top portion (see Fig. 17). Slide bottom portion of wrench around the yellow GRUNDOSTEER hose between the arms of the torque frame. Attach top part of wrench with pin and clip (see Fig. 18).

FIG. 17: SLIDE BOTTOM ON

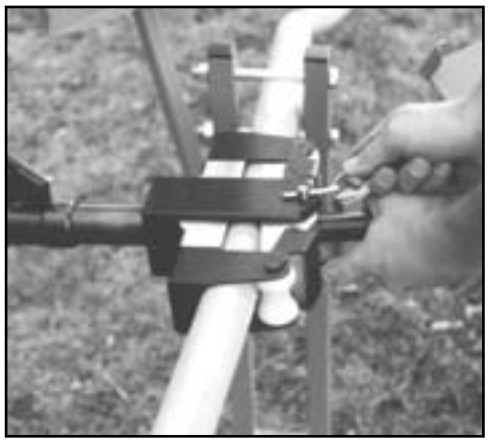


FIG. 18: CLIP TOP ON WITH PIN

To tension torquer around hose, engage hydraulic cylinder by pushing lever forward. This will allow the torquer to tension around the hose as the handle is pumped. To release pressure, disengage lever.

7. REMOTE

Secure remote in its holder and run cable back to the control unit. Connect the cable to the control unit making sure that the numbers of the prongs on remote and control unit line up.

IMPORTANT: Before attaching tool, open valve at lubricator, take off safety cap on male end of hose, start compressor, turn the remote on to start airflow. This will clean out the airline and prevent dirt and other impurities from entering the tool.

WARNING: System under pressure! Hold on to hose tightly, point away from face, make sure others are out of the way, wear eye protection. Shut compressor off before attaching hose to tool.

8. TOOL

Attach male end of yellow GRUNDOSTEER hose that has been fed through torque frame to the tool (see Fig. 19). There is a positive lock on the fittings for this connection. If 3 teeth are not aligned with 3 slits on the hose fitting, the connection will bottom out 2/3 of the way. Adjust and tighten completely.

FIG. 19: ATTACH TO TOOL

FIG. 20: ATTACH TO CONTROL BOX

CAUTION: Do not over tighten. Do not use wrenches.

Lay the GRUNDOSTEER in the bottom of the entry pit and turn on compressor. Make sure it is operating correctly by switching from forward to reverse and fast to slow.

Place DCI or RD receiver at front of starting pit. Turn on the DCI or RD remote display at the torque frame. Both receiver and remote display should read the same information clock position.

EXAMPLE: If the 12 on the tapered head is up it should read 12 on the receiver and remote display. Roll tool in both directions to make sure clock position changes on receiver and remote display.

Operation

5.

A. Alignment

On a straight shot the GRUNDOSCOPE and surveyors stake are handy accessories. Otherwise perfect alignment is not required because of the tool's steering capability.

B. Tracking

One person is needed to monitor the progress of the tool with the DCI or RD receiver. Mark the exact path of the tool with flags, paint, etc, every 10 feet. Marking the path displays how the GRUNDOSTEER has moved toward the target and helps prevent oversteering.

NOTE: Please consult locator user manual for tracking information and proper locator operational instructions.

C. Steering

One person needs to steer the tool. This person will receive the same information as the tracker and can adjust the tool as needed.

Planning ahead is essential to successful steering. Each shot should be mapped out prior to operation.

Steering is accomplished by rotating the air hose, with the hydraulic tensioning unit, (torquer) in order to rotate the tool head to the required position (see Fig. 21). Once the tool head is in the proper position, it will guide the tool in the chosen direction until a new direction is chosen.

NOTE: Depending on soil conditions, it takes on average 7 ft. to get the tool to react/change direction.

FIG. 21: STEERING TOOL

EXAMPLE: A straight shot, running at 5% positive pitch and at a depth of 40 inches, in the 12 o'clock position. Turn the GRUNDOSTEER hose until the tool reaches the 6 o'clock position in order to level out. The tool continues to lose depth over the next 7 ft. because it is moving toward leveling out and eventually steering downward to give a negative pitch. So, 10 ft. after the initial change to 6 o'clock the reading might be 0% pitch at 36 inches of depth.

D. Soil Conditions

The GRUNDOSTEER will operate in the same soil conditions as a standard piercing tool. For extreme rocky conditions TT Technologies recommends using the GRUNDOMAT piercing tool.

NOTE: Using the starting cradle is recommended in order to help keep the GRUNDOSTEER level. Run the tool on the slow speed and always start in the 6 o'clock position to keep tool from rising.

NOTE: If ground conditions are extremely soft the tool will move too fast and not "bite", steer, nor move. This is indicated by noticeable hose shaking.

NOTE: If slow speed on remote is not slow enough, cut air back at lubricator. If the air is cut back as far as possible, but the tool is not moving, push on GRUNDOSTEER hose.

IMPORTANT: It is possible to steer the tool while it is moving. Beware of oversteering.

E. Horizontal Straight Bore, No Slope, for use with tapered tool head (see Fig. 22)

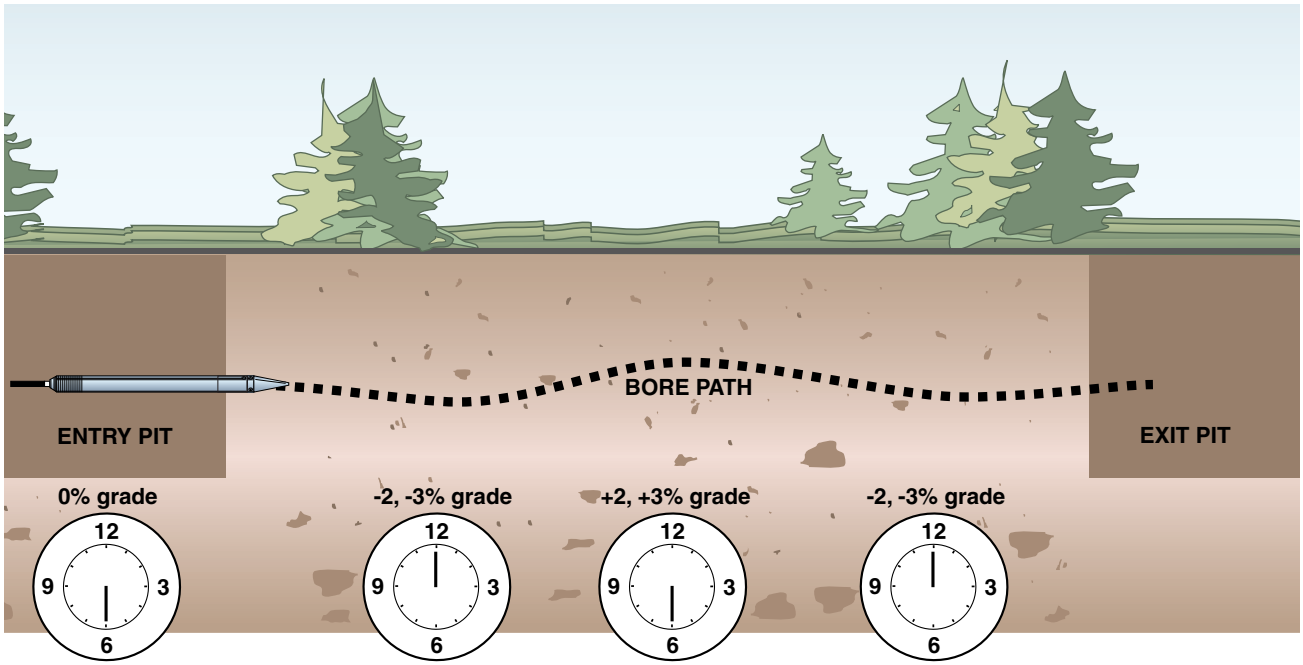


FIG. 22: The tool goes through a series of subtle pitch and depth adjustments, equaling zero, to achieve a straight bore. Start at 6 o'clock 0% grade, when you reach -2, -3% grade steer the tool to the 12 o'clock position. Once you reach +2, +3% grade, steer back to the 6 o'clock position.

1. Place GRUNDOSTEER in the 6 o'clock position on the starting cradle. If the GRUNDOSTEER is launched at the installation depth, the Dataview should read 0%. Position the tool with the assistance of a GRUNDOSCOPE aiming frame and surveyors stake.

   NOTE: Please consult locator user manual for tracking information and proper locator operational instructions.

2. Switch the compressor on and let the tool enter the soil slowly in the 6 o'clock position. Run the GRUNDOSTEER until the reverse cone has reached the soil.

IMPORTANT: Always launch the GRUNDOSTEER in the 6 o'clock position to prevent the tool from surfacing prematurely.

NOTE: A standard, non-tapered, tool head is available for straight horizontal boring with the GRUNDOSTEER. Do not follow this procedure for that tool head.

3. Remove the starting cradle. Do not tension the torquer at this point.

4. Bring the tool up to speed and continue boring in the 6 o'clock position, monitoring the tool's progress with the locator. Continue boring until the indicator reads -2% to -3%.

5. Tension the torquer around the special yellow compressed air hose.

6. Pre-tension the hose before putting the GRUNDOSTEER in reverse. Begin to turn the torquer toward the 12 o'clock position.

7. Reverse the GRUNDOSTEER, backing the tool up approximately 1-foot or more. Maintain tension and pay close attention to the data view.

8. Switch the GRUNDOSTEER back to forward with the remote control, maintaining tension toward the 12 o'clock position. Monitor the tool's position closely with the data view.

9. If the tool does not reach the desired 12 o'clock position after traveling forward 1-foot, repeat steps 7 and 8 until the 12 o'clock position is achieved.

10. Continue boring in the 12 o'clock position until the indicator reads +2% to +3%. At this point, turn the GRUNDOSTEER to the 6 o'clock position by using the same reverse/forward method described in steps 7 and 8.

11. Repeat steps 4 through 10 until the bore is complete.

F. Right Bend 3 o'clock Bore (see Fig. 23).

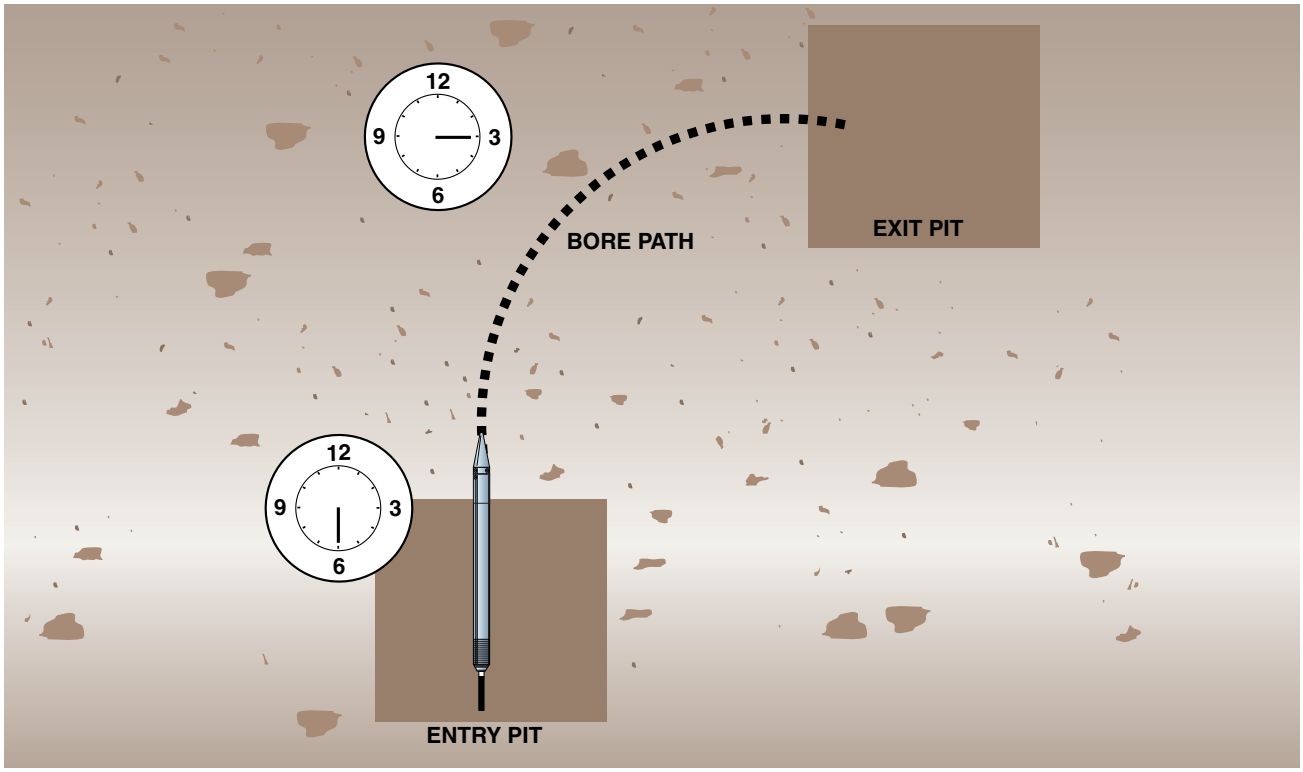


FIG. 23: Start at 6 o'clock position, then steer to 3 o'clock to make right bend. Typical bend radius = 85 feet.

1. Place GRUNDOSTEER in the 6 o'clock position on the starting cradle. If the GRUNDOSTEER is launched at the installation depth, the Dataview should read 0%.

   NOTE: Please consult locator user manual for tracking information and proper locator operational instructions.

2. Switch the compressor on and let the tool enter the soil slowly in the 6 o'clock position. Run the GRUNDOSTEER until the reverse cone has reached the soil.

3. Remove the starting cradle. Do not tension the torquer at this point.

4. Continue boring until the GRUNDOSTEER is in the ground approximately 3 feet.

5. Pre-tension the hose before putting the GRUNDOSTEER in reverse. Begin to turn the torquer toward the 3 o'clock position.

6. Reverse the GRUNDOSTEER, backing the tool up approximately 1-foot. Maintain tension and pay close attention to the data view.

7. Switch the GRUNDOSTEER back to forward with the remote control maintaining tension toward the 3 o'clock position. Monitor the tool's position closely with the Dataview. Loosen the torquer and remove tension from the hose.

8. Monitor the progress of the GRUNDOSTEER closely. If the tool slips into the 1 o'clock or 5 o'clock positions, repeat steps 5 through 7 in order to restore its proper coarse.

9. To change direction, repeat steps 5 through 7, turning the GRUNDOSTEER to the chosen direction.

G. Gradient Change, Hill Bore (see Fig. 24).

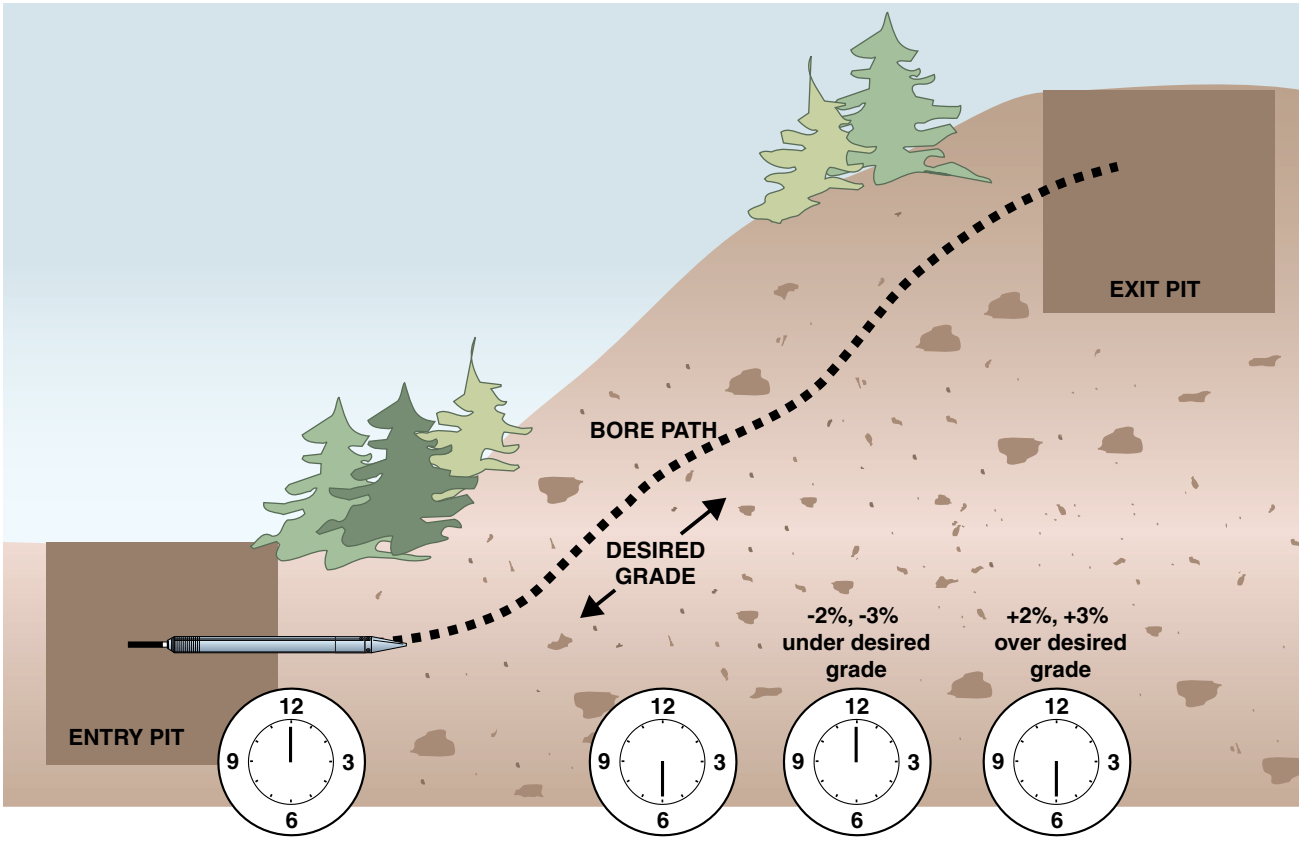


FIG. 24: Start at 12 o'clock position. Once the desired grade is achieved, alternate between 6 o'clock and 12 o'clock until the bore is complete.

1. Find the pitch or grade of the hill by laying the GRUNDOSTEER on the slope of the hill. While the GRUNDOSTEER is on the slope, use the tracking device to determine the grade of the hill.

   NOTE: Please consult locator user manual for tracking information and proper locator operational instructions.

2. If the bore takes place on a negative grade (downhill), launch the tool in the 6 o'clock position. If the bore takes place on a positive grade (uphill), launch the tool in the 12 o'clock position. Switch the compressor on and let the tool enter the soil slowly in the desired position until the reverse cone has reached the soil.

   IMPORTANT: Boring on a continuous downhill slope is not recommended. The inflow of ground water through the back of the tool can cause the GRUNDOSTEER to shut down.

3. Remove the starting cradle. Do not tension the torquer at this point. Continue boring.

4. Once the tool achieves the desired grade, run the GRUNDOSTEER between the 6 o'clock position and 12 o'clock position to maintain grade as described in Section E. Alternate between the two positions every 7 to 10 feet, depending on soil conditions. Continue boring in the 12 o'clock position until the indicator reads +2% to +3% over desired grade. At this point, turn the GRUNDOSTEER to the 6 o'clock position and bore until the indicator read -2% to -3% under desired grade.

Attachments & Accessories

6.

Starting Cradle & Accessories

Part Number	Description
GRU 0750011	Starting Cradle (with non-return roller), and Ground Stakes
GRU 2000030	Ground Stakes for Starting Cradle
G-E 0751000	Grundoscope 3'-5', with Aiming Frame and 5' Surveyor's Staff
G-E 0751002	Grundoscope 5'-6.6', with Aiming Frame and 6.6' Surveyor's Staff
G-E 0751110	5' Surveyor's Staff
GRU 2000130	6.6' Surveyor's Staff
GRU 2000180	9.8' Surveyor's Staff

Torquer, Frame & Air Hose Accessories

Part Number	Description
G-L 0752255	65.6' Compressed Air Hose with internal control hose and torsion-proof round thread couplings
G-L 0752255A	32.8' Compressed Air Hose with internal control hose and torsion-proof round thread couplings
G-L 0753400	Manual Tensioning System (Torquer) with Bearing Frame
YY 051920	Manual Tensioning System (Torquer) without Bearing Frame
YY 051941	Bearing Frame
G-L 0752300A	Control Unit with Electric-Activated Magnet Valves
G-L 0752320	Cable Remote Control with Foot-Switch and 82' Cable for Controlling Unit

DigiTrak & Radio Detection Locating Accessories

Part Number	Description
SEN 0705	DigiTrak Mark III System with Special Transmitter (without Dataview)
98SDRR3	Receiver DRR3
98CDCC	System Case DCC
98CDBC	Battery Charging Unit DBC (115 V & 230 V)
98CDBP	Battery Pack DBP
SEN 0205	Transmitter DS Short-Range without Sleep-Mode
98CDMAN	DigiTrak Manual
98CDDC	Remote Transmission Monitor (Dataview) DDC3
SEN 0700	Radio Detection System with Special Slim Sonde (without Dataview)
9913036	Receiver RD 385
9943007	Bag for RD 385 Location System
SEN 0200	Slim Sonde without Sleep-Mode
9913038	Remote Transmission Monitor (Dataview)

Lubricators & Accessories

Part Number	Description
GRU 2002291	Lubricator, 1 gallon with Stopcock, w/o Hose
GRU 2002520	6.6' Connection Air Hose DN 25 with Mody Couplings
GRU 2002300	3.3' Connection Air Hose DN 25 with Mody Couplings
GRU 2002060	Locking Coupling for Mody Couplings
GRU 2002308	.3 Gallons GRUNDO-OIL
GRU 2002311	1.3 Gallons GRUNDO-OIL
GRU 2002317	6.6 Gallons GRUNDO-OIL
GRU 2002312	13.2 Gallons GRUNDO-OIL (2-6.6 gal. cans)
GRU 2002313	52.8 Gallons GRUNDO-OIL (8-6.6 gal. cans)
GRU 2002309	.3 Gallons GRUNDO-OIL Extra
GRU 2002314	1.3 Gallons GRUNDO-OIL Extra
GRU 2002318	6.6 Gallons GRUNDO-OIL Extra
GRU 2002315	13.2 Gallons GRUNDO-OIL Extra (2-6.6 gallon cans)
GRU 2002316	52.8 Gallons GRUNDO-OIL Extra (8-6.6 gallon cans)
GRU 2004110	1" x 32.8' Special Rolled Hose with Claw Couplings
GRU 2004120	1" x 65.6' Special Rolled Hose with Claw Couplings

Pipe Pullers & Accessories

Part Number	Description
G-L SN2535A	Pipe Puller 25-35 with Socket
G-L SN2535B	Pipe Puller 25-35 with Plug
G-L SN3545A	Pipe Puller 35-45 with Socket
G-L SN3545B	Pipe Puller 35-45 with Plug
G-L SA2410A	Pipe Puller DN 50 with Socket PE 80 PN4(SDR26)-PN10(SDR11)
G-L SB2410A	Pipe Puller DN 50 with Plug PE 80 PN4(SDR26)-PN10(SDR11)
G-L SA2420A	Pipe Puller DN 63 with Socket PE 80 PN4(SDR26)-PN10(SDR11)
G-L SB2420A	Pipe Puller DN 50 with Plug PE 80 PN4(SDR26)-PN10(SDR11)
YY 051968	Cable Connection Nipple with Hose Coupling Socket
YY 051969	Cable Connection Nipple with Hose Coupling Plug

GRUNDEX Mud-and-Water Pump & Accessories

Part Number	Description
GRU 2001032	GRUNDEX II Mud & Water Pump, without Connection Hose
GRU 2001033	9.8' GRUNDEX Connection Hose with C-hose Coupling
GRU 2001036	16.4' GRUNDEX Connection Hose with C-hose Coupling

Maintenance Tools & Accessories

Part Number	Description
GRU 2003290	Assembly Table for GRUNDOSTEER
GRU 0753300	GRUNDOCLAMP 75 (Assembly Clamp)
GRU 2003291	Assembly Table (Lightweight) with Simple Clamping Device
G-L 0753500	Tool Box
GRU 0753540	C-Spanner D76 (set=2 pieces)
GRU 0753541	C-Spanner D76 (1 piece)
G-E 0753550	Open-Jawed Spanner
GRU 2003530	Piston Extractor

Maintenance

7.

The tool should be flushed with air tool oil after each usage, and again before any period of extended storage. This helps prevent premature failure of the teflon seals.

Seals should be inspected and replaced as needed after every 400 work hours or one year of usage.

- Charge battery in control unit overnight after each use
- Flush tool with Grundo-oil lubricant and diesel fuel mixture after each bore
- Keep out dirt and elements by always using provided end caps for tool, hoses, lubricator, control unit and remote.
- Take head assembly apart daily, must be done for sonde battery purposes anyway. Clean all dirt before reassembling for next shot.

Troubleshooting

8.

PROBLEM: Tapered head, barrel of tool and hose will not rotate freely inside of oversized sleeve.

SOLUTIONS:

- Roll pins not installed correctly.
- Dirt build-up in sleeve. Clean sleeve.

PROBLEM: You have been steering at 3 o'clock but the tool is turning in the 9 o'clock direction.

SOLUTIONS:

- Sonde has been improperly installed, check to make sure 12's line up.

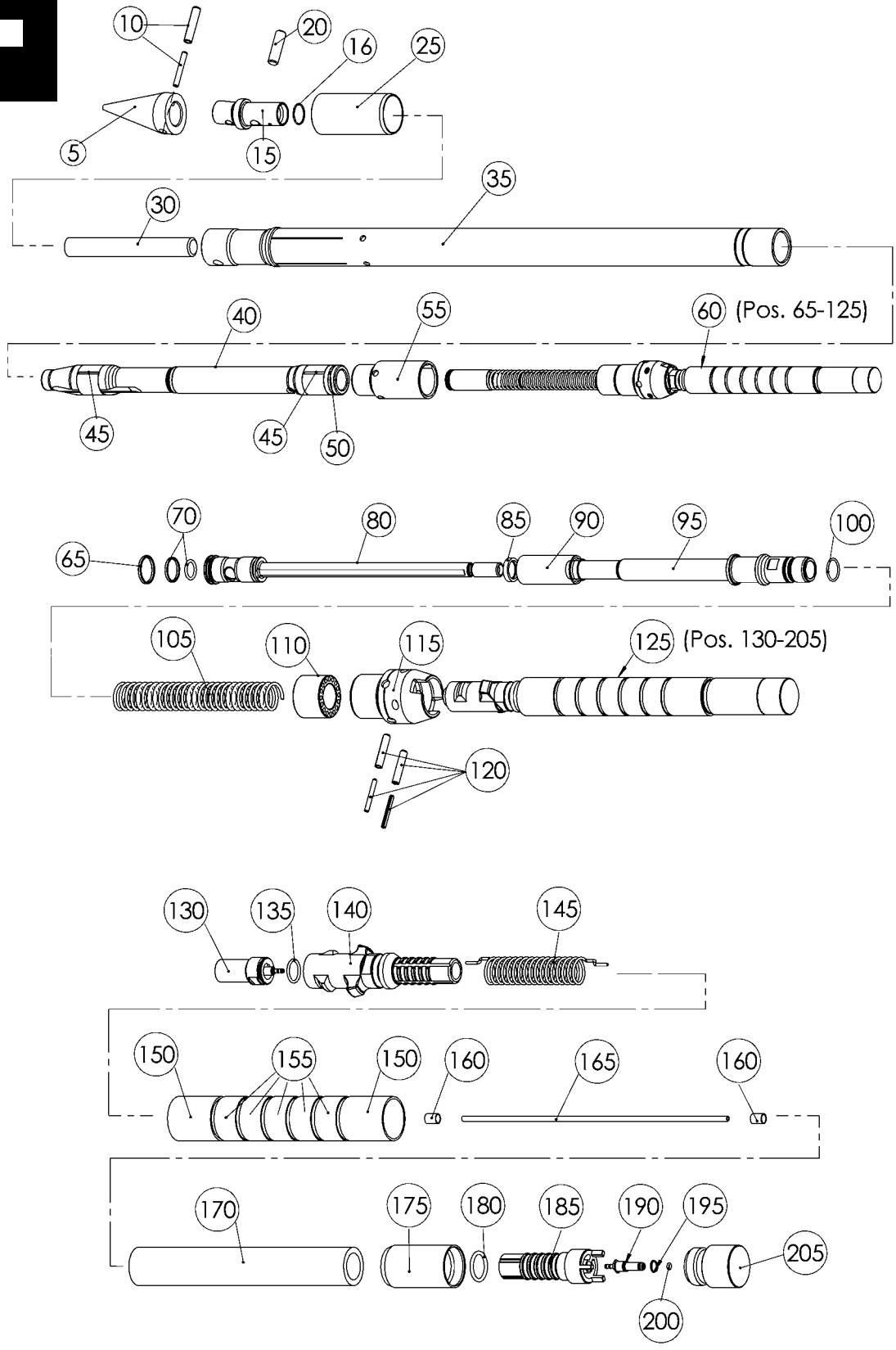
PROBLEM: Tool will not start.

SOLUTIONS:

- Emergency off switch has been pressed on control unit.
- Check all hose connections.
- Control unit 12 V battery is dead.

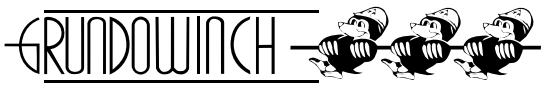
Replacement Parts List

9.



GRUNDOSTEER- 75 PS			
Ref.	**Qty**	**Description**	**Part Number**
5	1	Steering Head	YY 051908
5	1	Steering Head, Straight	YY 052009
10	1	Roll Pin Kit	RZ 2201102
15	1	Steering Head Adapter	YY 051910
16	1	O-Ring, 40x 2.5 mm	21252496
20	1	Head Adapter Pin	YY 052011
25	1	Rotation Sleeve	YY 051914
30	1	Sonde Sleeve (Inner Tube for Transmitter)	YY 051809
35	1	Casing	YY 051810
40	1	Piston	G-P 0755141
45	1	Piston Slide Tapes (set)*	G-P 0755130
50	1	Piston Seal*	G-P 0755160
55	1	Control Stud Housing	G-Z 0756460
60	1	Control Stud (Complete, with Connection Hose)	G-L 0758004
65	1	Control Seal	YY 191636
70	1	Control Sleeve Seal (set)*	G-L 0758075
80	1	Inner Tube	YY 050931
85	1	O-Ring 24/33x7	21025005
90	1	Reverse Sleeve	YY 050930
95	1	Outer Tube	YY 050932
100	1	O-Ring, 30x2.5 mm	21251967
105	1	Spring	YY 050934
110	1	Elastic Block	YY 051991
115	1	Reverse Cone	G-L 0756450
120	1	Roll Pin Kit	G-L 0756452
125	1	Whip Hose (Complete, NW 32)	G-L 0752200
130	1	Reversing Manifold	YY 050933
135	1	O-Ring, 26x3 mm	21251753
140	1	Lock Piece	YY 052006
145	1	Structural Spring for Whip Hose NW 32	YY 051882
150	2	Hose Crimp, 55x2.5x60	G-L 0752360
155	5	Structural Band, 53x1.5x30	G-L 0752363
160	2	Shift Hose Crimps, 12x1x40	YY 060969
165	1	Control Hose (Internal) 0.37 m, without Couplings	G-L 0752205
170	1	Air Hose, without Couplings DN32, 300 feet long	G-L 0752210
175	1	Threaded Sleeve for connection to Air Hose DN 32	YY 060978
180	1	O-Ring, 33x4 mm	21252128
185	1	Hose Nipple with Socket	YY 051869
190	1	Air Fitting	YY 060981
195	1	Snap Ring, 12x1 mm DIN 471	180471010012
200	1	O-Ring, 6.5x2 mm	21250387
205	1	Hose Cap for DN 32	YY 060988
5-205	1	GRUNDOSTEER 75 PS with Connection Air Hose (w/o Transmitter)	G-L 0750000
		Complete Seal Kit	G-L 0756320

Get to Know the Mole



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